

## **India's Nuclear Security Vulnerabilities and Commitments : Considering Cyber Threats and Nuclear Material Trafficking**

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**ABSTRACT :** Nuclear security refers to the prevention and detection of illegal or purposeful unauthorised acts with nuclear material, other radioactive material, associated facilities, or associated activities, as well as the reaction to such criminal or intentional acts. The nuclear domain is constantly confronted with the problems posed by existing and developing dangers related to nuclear security. After the September 11 terrorist attacks in the United States, public perceptions of nuclear security concerns grew significantly. The advancement of technology has increased the number of security breaches. This is evidenced by the increasing number of cyberattacks on nuclear power plants. After this point in time, the global nuclear community has channelled its efforts toward the establishment and strengthening of global institutions and norms, as well as international regimes, in order to establish and/or maintain robust and protective mechanisms in the domain of nuclear security. Ultimately, the individual sovereign nation has the burden of responsibility for nuclear security, with India being one such responsible nuclear actor. There are a variety of reasons why nuclear security is crucial for India. Due to its extensive nuclear programme and the dispersion of its atomic energy installations around the country, India has a huge vulnerability. Additionally, given India's unfriendly immediate neighbours, the country is particularly vulnerable to nuclear terrorism, cyberattacks, and other new threats. The study examines India's nuclear security initiatives, the dangers they confront, and the possible means to counter the threats.

**Keywords:** India, Nuclear Security, 9/11 Attacks, Nuclear Energy, Cyber Attacks.

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## INTRODUCTION

The nuclear domain is constantly confronted with existing and emerging risks to nuclear security and proliferation. Nuclear security dangers were elevated to a new level of seriousness following the 9/11 terrorist attacks in the United States (U.S.). Since then, the worldwide nuclear community has focused its efforts on developing and strengthening global norms, institutions, and regimes with the goal of establishing and/or strengthening robust and protective mechanisms in the realm of nuclear security. The relevance of nuclear security is discussed in this article through an examination of existing programmes, practices, and infrastructures, as well as insider threats, emergency response readiness, and emerging technology risks.

The International Atomic Energy Agency (IAEA) defines nuclear security as “the prevention and detection of, and response to, criminal or intentional unauthorised acts involving nuclear material, other radioactive material, associated facilities or associated activities” (IAEA, n.d.). Nuclear security also encompasses “The prevention and detection of and response to theft, sabotage, unauthorised access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities” (IAEA n.d.). Nuclear security is primarily concerned with deliberate and malicious actions that endanger human life. Nuclear security efforts are geared at preventing, detecting, and responding to purposeful harmful acts involving radioactive chemicals or directed at facilities or activities that make use of such substances.

Nuclear or radioactive material of any kind, whether in use, storage, or transport, must be safeguarded to avoid causing harm or disturbance to society. The rise of cyber-threats and other new technologies that could be used in attacks or to defend against assaults has increased public awareness of the critical nature of nuclear security. Over the last decade, there has been a resurgence of interest in modernising methods for countering nuclear security risks on both the national and international levels. Nuclear Security Summits, as well as the national commitments made during them, are examples of this approach. In India’s setting, the security environment necessitates more attention to nuclear security systems, particularly the institutional infrastructure, in order to further reinforce policies and practices. There are growing concerns about nuclear security, which are not unfounded.

According to Illicit Trafficking Database (IAEA) 2020, “More than 3686 incidents have been reported since 1993. In 2019 alone, 189 incidents were reported to the ITDB by 36 States, indicating that unauthorised activities and events involving nuclear and other radioactive material, including incidents of trafficking and malicious use, continue to occur” (IAEA, *Incident and Trafficking Database (ITDB)*, 2020). Internationally, the Nuclear Security Summit (NSS)

initiative, which began in 2010, was an international attempt to focus attention on nuclear materials' global security and address potential vulnerabilities in security standards. Since then, three other summits of this type have been held in 2012, 2014, and 2016. Though the United Nations did not sanction this campaign, it was instrumental in persuading several governments to make individual pledges in the form of 'gift baskets' or voluntary national commitments. Inspired by the NSS's in-depth emphasis, Prime Minister Narendra Modi pledged to assume a significant role in sustaining the debates (Business Standard News, 2016).

An in-depth discussion of nuclear security involves a thorough examination of the different factors that influence the success and development of nuclear security architecture. The security patterns have evolved over a period of time. Keeping nuclear material and installations safe is a crucial component of the national nuclear security system. India has been trying hard to keep its nuclear facilities and materials safe from insider as well as outsider threats. Through INFCIRC/225/Revision 5, which provides Nuclear Security Advice on Physical Protection of Nuclear Material and Nuclear Facilities, provides recommendations for States on establishing or improving, implementing and maintaining adequate physical protection of nuclear material and nuclear facilities (International Atomic Energy Agency, 2021).

## **THEORETICAL REVIEW**

### *The Nuclear Power Industry's Safety and Security*

Because of its enormous constructive as well as destructive potential, nuclear technology has elicited feelings of both wonder and dread ever since it was first developed. Civil nuclear energy is regarded as a benign and beneficial aspect of this technology. The world's nuclear power reactors, which currently number 443 and are located in 31 nations, generate around 10% of the world's electricity at any given time (World Nuclear Association, 2022). Furthermore, 52 reactors are now under development, the most of which are in India, China and Russia. The balance sheet might be considered to be mixed, meaning that nuclear technology has yielded both successes and failures.

Although there were no fatalities in the March 2011 catastrophic catastrophe at the Fukushima nuclear power plant in Japan (World Nuclear Association 2022), the accident derailed the global nuclear renaissance, as numerous countries elected to phase out their nuclear power programmes as a result of the accident. On the other hand, India is not discouraged by the fact that it has large-scale requirements for a diverse range of energy sources. On the other hand, the country has been increasing its safeguards to ensure improved nuclear

security standards. There are now 23 nuclear power reactors in India, with an additional 11 reactors in the building phase (World Nuclear Association, 2021). In addition, the country has inked a number of nuclear pacts with countries such as the United States, Russia, France, Canada, and the United Kingdom (Mohan Pulkit & Aggarwal Pallav, 2019).

Power is critical in the achievement of many countries' development objectives, including India, because renewable energy sources like solar and wind are insufficient to meet both domestic energy demands and global climate change objectives. Nuclear power offers India the opportunity to improve its energy security while also contributing to the reduction of global CO<sub>2</sub> emissions and the mitigation of climate change and global warming. India has a long history of using nuclear energy for civic purposes. Since the construction of two small boiling water reactors at Tarapur in the 1960s, India's civil nuclear strategy has been geared toward achieving complete independence in the nuclear fuel cycle, which is necessary because the country was excluded from the 1970 Nuclear Non-Proliferation Treaty (NPT) due to the acquisition of nuclear weapons capability after that year. Under the Nuclear Non-proliferation Treaty (NPT), the five countries that did so prior to 1970 were designated as Nuclear Weapons States (UNODA, n.d.).

India was self-sufficient in nuclear energy, from uranium discovery and mining to fuel fabrication, heavy water production, reactor design and construction, and waste management. It currently has a tiny fast breeder reactor and is constructing a much larger one. It is also exploring technology to use its substantial thorium resources as nuclear fuel (World Nuclear Association 2021). Indeed, nuclear energy is critical to ensuring that everyone has access to affordable energy; its significance in promoting clean energy cannot be overstated. It has emerged as a significant carbon-free energy source for producing electricity in a safe and sustainable manner. However, a slew of problems with this energy have dire ramifications, leading some to question its usefulness.

This is especially true after events like the 9/11 US attacks and 3/11 when Fukushima had a nuclear disaster. Nuclear material and technology are critical to keeping safe and secure. Many people think that catastrophic nuclear accidents are inevitable because designers and risk modellers cannot think of all the ways that complex systems can fail. There is no absolute safety, "security measures can become obsolete" as time goes on, and people will misuse technology (Mishra Sitakanta, 2017). Assuring safety is undeniably difficult work and an obligation that necessitates constant attention

### *Security Measures by India*

The Indian government has taken five different approaches to ensure nuclear security. These strategies are aimed at safeguarding nuclear resources such as weapons and reactors from malicious intent.

### *Framework for Governance*

India has adopted many legislations to provide nuclear security. As amended, the Atomic Energy Act of 1962 and the Rules and Notifications promulgated pursuant to it, such as the Rules on Safe Disposal of Radioactive Waste (1987) and Radiation Protection (2004), form the bedrock of India's framework for nuclear governance. Additional legislative authority for regulating nuclear sales and transfers is provided by the Foreign Trade Development and Regulation Act (FTDR) of 1992 and the Weapons of Mass Destruction (WMD) Act of 2005.

The FTDR was updated in 2010 to tighten protections against technology leakage. The Atomic Energy Act's Guidelines for Nuclear Transfers were established in July 2010 to control trade by authorised firms, including overseas partners. While this is not strictly a nuclear security problem, AERB guidelines for the usage of radioisotope-based scientific instruments have been strengthened in the aftermath of a 2010 safety incident involving a decommissioned device in New Delhi's Mayapuri neighbourhood (External Affairs Ministry, n.d.).

### *Institutions*

Since 1983, the Atomic Energy Regulatory Board (AERB), established under the Atomic Energy Act, has operated independently of India's nuclear power operator. AERB has placed a premium on nuclear safety as well as the security of civilian installations. At India's strategic sites, separate institutions and operating processes for nuclear security exist. As of 2013, the Department of Atomic Energy (DAE) established a Nuclear Controls and Planning Wing (NC&PW) to unify the DAE's safeguards, export controls, and nuclear security functions. In coordination with the Ministry of External Affairs, the NC&PW leads worldwide cooperation on nuclear security.

The widespread use of information technology in many systems and the growing worry about potential assaults on these systems are addressed by the Computer Information and Security Advisory Group (CISAG), which conducts periodic audits of information systems. Additionally, it has established policies and procedures to combat cyberattacks and limit their negative consequences. Specific guidelines are being prepared to address the dangers associated with

network-connected control and instrumentation systems used in various sites (External Affairs Ministry n.d.).

### *Nuclear Security Practices and Cultural Attitudes*

Nuclear security within the confines of an Indian nuclear site must be integrated into the facility's technology design and is approved by the AERB. India maintains a national Design Basis Threat (DBT) document. Each facility maintains a local DBT document, prompting the establishment of their own DBT document based on the national DBT to design physical protection systems at their plant. The Indian DBT considers the threat posed by saboteurs, thieves, terrorists, and maybe other malevolent actors, as well as their distinctive capabilities and techniques as well as the possibility of coordination with insiders. A specially trained paramilitary force known as the Central Industrial Security Force (CISF), which is subordinate to the Ministry of Home Affairs, is stationed at nuclear facilities and reports to a senior Indian Police Service (IPS) officer who can coordinate the deployment of additional forces as necessary. CISF troops assigned to nuclear sites are rotated on a regular basis and undergo specialised training. "India has every reason to be proud of its nuclear security culture - There has not been a single severe security event in the more than five decades of the Indian Nuclear Program" (External Affairs Ministry n.d.).

Other national-level bodies and the CISF are participating in DBT assessments and nuclear security audits. At Indian nuclear reactors, a variety of detection, surveillance, delay, reaction, and access control mechanisms are deployed in four layers around the most vulnerable areas of the facility. A team of independent regulatory bodies audits the physical protection system on a regular basis (AERB). In the daily practice of nuclear security, India's national system of Nuclear Material Accounting and Control (NUMAC) and personnel reliability measures play essential roles.

India has every right to be proud of its nuclear security culture, which is cultivated by institutions like the BARC Training School. In the more than five decades of the Indian nuclear programme, there has not been a single severe security issue, owing in great part to the human aspect.

### *Technology*

The technology dimension of nuclear security in India has two facets. The first is the development and deployment of portals, radiation detectors, secure communication networks, radio frequency identification cards, real-time tracking systems for safe vehicular transport, infrared cameras with video analytics, sensors, and obstacles, among other technologies (External Affairs Ministry n.d.). The majority of these technologies were created in-house. The second dimension is proliferation-resistant nuclear fuel cycle technologies and

processes that minimise the possibility of a nuclear security or safety violation. India is seeking a closed fuel cycle with reprocess to reuse' plutonium, which prevents the accumulation of stocks and the need to store huge quantities of spent fuel in underground repositories that may become easy-to-access plutonium mines in the future. Indian scientists are also developing and deploying proliferation-resistant reactor designs, such as the Advanced Heavy Water Reactor (AHWR), which uses thorium and U233 and is associated with the high-energy gamma-emitter U-232, making access and use by unauthorised non-state entities problematic. India has also developed technology for vitrifying trash, which has the added benefit of preventing terrorists from obtaining high-level waste in order to manufacture a radioactive device.

#### *International Cooperation*

Today, worldwide cooperation is required to address nuclear security risks, especially nuclear terrorism. India is a signatory to all thirteen anti-terrorism agreements, including the International Convention to Suppress Acts of Nuclear Terrorism (ICSANT). It is a party to the Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment, which expanded the scope of the Convention to include domestic transportation of nuclear material. India follows the IAEA's guidance on the physical protection of nuclear material contained in the document INFCIRC/225/Rev 5 and the Nuclear Supplier Group's (NSG) Guidelines on nuclear transfers and associated requirements (External Affairs Ministry n.d.).

India has been an active member of the IAEA's safeguards system, placing civilian sites under safeguards voluntarily in conformity with the IAEA's safeguards agreement. While the World Association of Nuclear Operators (WANO) previously conducted peer evaluations of Indian power plants, India has invited the IAEA's OSART to undertake a safety review of two units in Rajasthan; the IAEA has also been requested to conduct a regulatory peer review of AERB. India recently made a USD 1 million contribution to the IAEA's Nuclear Security Fund (NSF). Since 2002, India has sponsored a resolution at the United Nations on WMD terrorism and has advocated for the implementation of U.N. Security Council Resolution 1540, which prohibits the transfer of WMD to non-state actors. India has filed both a national report on the 1540 and updates to that report. In November-December 2012, India sponsored an international workshop on UNSCR 1540 and new aspects of nuclear security. India is a member of the IAEA's Illicit Trafficking Database (ITDB), established in 1995 to communicate information to States concerning confirmed reports of illicit trafficking and other unlawful nuclear radioactive material-related activities and occurrences. India has been a member of the Global Initiative to Combat Nuclear

Terrorism since 2007 and has engaged in the initiative's working groups on nuclear detection, nuclear forensics, and nuclear response and mitigation. India also collaborates on nuclear trafficking issues with Interpol's Radiological and Nuclear Terrorism Prevention Unit and the World Customs Organization (External Affairs Ministry n.d.).

These techniques aim to safeguard people, property, and the environment while also providing the highest levels of security possible. The steps that have been implemented in each of these five areas have contributed to the overall security and safety of India's nuclear programme. India will see more and more nuclear projects in the years to come, no matter how fast they are going now. The goal is to spread the use of nuclear energy by involving many public and private organisations. This means that the safety of reactors, nuclear materials, and nuclear power plants would be the most important thing to keep in mind.

#### *Nuclear Security Vulnerabilities*

The majority of people in India are proud of the safety record of the country's nuclear power plants, but a few people call them "false claims," even though the majority of people think they are true (Subbarao, 1998). Others who mostly are anti-nuclear activists who do not like India's plans to use nuclear energy because of both safety and environmental reasons. People like Praful Bidwai think that nuclear accidents happen because of the way that nuclear technology works. There is nothing natural that makes them more likely. All types of reactors can have core-meltdown accidents (Bidwai Praful, 2011). The second group is made up mostly of people who used to work in the nuclear industry, as well as academics and researchers and scientists. They say that India's nuclear organisation and regulatory framework are "a total farce." A.H. Nayyar, M.V. Ramana, and other people say that "spending more money on safety cannot stop small failures from combining to cause a disaster, and it might even cause new problems" (Mian Zia et al., 2010). People and nuclear reactors do not go together, because nuclear reactors are dangerous. People can get into accidents, and accidents can hurt people. Operator error was a factor in the accidents.

These people say that India's nuclear power plants are "mismanaged", and that many violations of basic safety standards have been "covered up". The Atomic Energy Regulatory Board, which regulates nuclear power, has "no autonomy," and "a veil of secrecy" covers the nuclear power programme, which "helps hide from public view the huge sums that are being wasted to produce a tiny amount of our power needs."<sup>1</sup> "There are a lot of people who say there have

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<sup>1</sup> Under the provisions of the Atomic Energy Act (1948), the Atomic Energy Commission (AEC) was constituted in 1948 to frame national policies on nuclear energy production. The DAE, established in 1954,

not been any big accidents in this field. However, a realistic look at the claim that “India’s safety record has been excellent” (Mishra Sitakanta 2017) needs to be done with the Plant Load Factor (PLF)<sup>2</sup> in mind, because all Indian reactors have not yet been used to their full power.<sup>3</sup>

In the years before the Indo-US civil nuclear deal, the gross life-time capacity utilisation rate of Indian reactors ranged from 37 to 60% (Gopalakrishnan, 1999). Theoretically, one might think that when more uranium is brought into India and more reactors from different operators start up, there will be more safety issues. This means that stricter safety measures will be needed. To make sure that nuclear operations are safe, they need to have enough technical knowledge and strict rules. Many people think that the AERB does not have any power because it gets its money, staff, technical help, and materials from the Department of Atomic Energy (DAE). Also, it is said that there is a “void of nuclear expertise outside of the DAE” for independent criticism of how the DAE works (Mishra Sitakanta 2017). To figure out how safe India’s nuclear plants are, one needs to look at how the plants work together, how well the regulatory body can do its job, and how the plants follow the safety rules that they follow. There are additional security risks that pose grave threats to nuclear security.

The cyber threats to civilian and military nuclear installations have received little attention in the past. Despite the changing and rising threats of cyber warfare and attacks, India’s cyber security policy has remained inadequate, particularly in crucial industries such as nuclear energy. Both the headquarters of the Indian Space Research Organisation (ISRO) in Bengaluru and the Kudankulam nuclear power plant in Tamil Nadu experienced security breaches in late 2019 (Robbins Melissa, 2019). The level of access gained as a result of a cyber-attack determines the severity of the attack. The potential of an adversary to acquire access to NC3 systems, for example, has special and multi-level ramifications in the context of military nuclear systems. If an adversary acquires access to a nuclear weapons system’s command and control infrastructure, they will be able to circumvent the weapons’ security and launch or employ nuclear

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is responsible for the execution of the policies laid down by the AEC. For review and verification of safety related issues, the AERB was constituted on November 15, 1983, directly under the AEC as an “independent regulatory authority”, “totally independent of the DAE”

<sup>2</sup> Plant load factor is the amount of power produced by a generator divided by the engineering capacity of the unit. Usually, load factors are stated for a year. The calculation, then, is the total kilowatt hours of power generated by the unit divided by the capacity of the unit in kilowatts times the number of hours in the year.

<sup>3</sup> Five reactors (960 MW) use imported uranium and are being operated at high PLFs. Fourteen reactors are fuelled by domestic uranium which is not available in the required quantity. These reactors are being operated at lower power levels to match the fuel availability, resulting in lower average PLF. The government has taken a series of measures to augment fuel supply from domestic and import sources which have resulted in increase in average annual PLF from 50 percent in 2008-09 to 61 percent in 2009-10. <http://indiacurrentaffairs.org>, May 6, 2010.

warheads or missiles without authorisation (Pillai et al., 2016). India was among the top five countries in the world facing cyber threats and targeted assaults in 2018, according to an internet security threat assessment published by security software company Symantec (Symantec, 2018).

In recent years, international society has been increasingly concerned about terrorism, but there has been less attention paid to one particular component of the problem - nuclear terrorism. However, in the context of South Asia, this is of particular significance, considering the large number of insurgencies and independence movements with transnational connections, as well as the region's nuclearization since 1998. Of all the South Asian countries, India's nuclear facilities are the most vulnerable to nuclear terrorism (Kazi, 2009). This is due to the country's extensive nuclear programme, which is not completely covered by International Atomic Energy Agency safeguards. Aside from that, India's nuclear plants are made much more vulnerable by the country's burgeoning underworld and the more than a dozen insurgencies that are currently taking place around the country.

India's internal discussion over the fear of dangers to its nuclear sites is primarily motivated by four subsequent developments. To begin, the worldwide discussion over nuclear terrorism, particularly in the post-9/11 period, has had a significant impact on India's national security discourse. Second, the Indo-US strategic relationship has created dread of Al Qaeda threats, since anyone perceived as an ally of the U.S. becomes a target of Al Qaeda. Third, Pakistan's political instability and concern of its nuclear arsenal slipping into the hands of extremist-terrorist groups, as well as the fact that Pakistan is a hub of terrorism that has targeted India, have garnered considerable attention. Finally, isolated instances of radiological material smuggling have been documented over the last few decades, and terrorist organisations such as Al Qaeda have shown an interest in acquiring nuclear materials (Mishra Sitakanta 2017).

Smuggling of uranium and radioactive substances has been recorded on a sporadic basis in India. According to a report, illicit uranium was removed from the Jaduguda uranium mines in Jharkhand and was planned to be smuggled across the Bangladeshi border in 2001 after being confiscated from suspected terrorists in Balurghat, northern West Bengal (Prosser, 2004). On September 10, 2008, five persons were arrested in Meghalaya for reportedly attempting to transport uranium (Mishra Sitakanta 2017).

Additionally, infrequent instances of misconduct and events within India's nuclear establishment have fuelled speculation of an insider danger. One such occurrence occurred in November 2009, when personnel of the Kaiga nuclear power plant's maintenance section were treated for radiation sickness after ingesting tritium-contaminated water. Authorities believe the cause of the

poisoning, which impacted 55 employees, was located to a government facility's drinking water cooler. India's then-Minister of Science and Technology, Prithviraj Chavan, stated in a clarification that an insider at the factory was suspected of poisoning the cooler with "heavy water" (Water Cooler at Indian Nuclear Plant Contaminated, 2009). In 2018, the detective department in Kolkatta apprehended five people who claimed to have gone to Kolkatta to sell one kilogramme of Uranium worth Rs 3 crore on the open market (Ghosh Dwaipayan, 2018).

In another case, On May 5, 2018 the Maharashtra Anti-Terrorism Squad (ATS) apprehended two persons in possession of radioactive materials. The duo was apprehended with 7.1 kg of natural uranium valued at Rs 21.3 crore. The case was taken by the National Investigation for further inquiry (Sandhu Kamaljit Kaur, 2021).

## CONCLUSION

The road to making sure that a strong nuclear security system is safe and long-lasting is hard. It cannot be hundred per cent safe, so the plan India came up with for nuclear and radiological security is not a last one. People in India want to make sure that the nuclear security framework is always being updated and improved. They want to make sure that the necessary mechanisms are in place and that they take the right steps. People in the country must have a sense of security that is in line with how well the country's security system works. In their report, the IRRS-team (Integrated Regulatory Review Service, IAEA) said that India should pay attention to "certain issues that need to be addressed or improved." They also said that "considering these would improve the performance of the regulatory system" (Mishra Sitakanta, 2017).

These "issues" include a national policy for safety, a radioactive waste management plan, an independent regulatory body for the AERB, more on-site inspections at nuclear power plants, and giving the AERB an emergency response role. India takes the suggestions very seriously and is working hard to improve and upgrade in these areas, as well. India is also working on improving its detection and response systems so that it can prevent and respond to any nuclear or radiological accident anywhere in the country. India also thinks it is important to have a national policy and plan for dealing with radioactive waste. As a responsible nuclear weapons state, India has shown that it wants to make sure that nuclear security is high at the national level. India's efforts to improve nuclear security show that it wants to build a strong and long-term nuclear security architecture both at home and around the world.

Charles D. Ferguson has published a report on military and terrorist threats targeting Indian civilian nuclear installations in which he believes that the

sheer complexity of India's "three-pronged strategy" may hamper administration of guaranteeing proper security throughout the programme. "Differential reactor designs "would necessitate close examination of the differences in vulnerability to various attack scenarios" (Ferguson, 2007). There have been some cyber-attacks over India's nuclear establishment as well as some incidents of nuclear material trafficking, which is concerning India. India has compelling reasons to safeguard the security of its nuclear facilities to the highest possible standard. Furthermore, in addition to India's ambitious plans for nuclear energy expansion, the deteriorating regional security environment, clandestine proliferation, and the existence of thriving terror and smuggling networks in its immediate neighbourhood, and most of all, the unique nature of its nuclear programme, nuclear security in India must be given the highest priority.

There is also the view that risk is inherent in every industrial activity, including nuclear, but it can be made quite small. With proper management techniques, the security risks, proliferation hazards, and safety risks can be minimised to the extent that the benefits can outweigh the inherent risks. Noteworthy safety-security lapses continue to occur in every industrial sector around the globe, even in countries with extensive operational experience and strong regulatory capabilities. The world has not abandoned those industrial projects – rather, the focus has been to study what went wrong and try to fix it. Conversely, the case with the nuclear industry is strange.

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